Soil management in South Australian vineyards

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Summary

Weed control in South Australian vineyards is discussed in relation to irrigation and other cultural practices. Good control of three-cornered jack, caltrop and spiny burr grass under vines can be achieved with combinations of pre-emergent and knockdown herbicides. Inter-row control of weeds with regular cultivation is difficult, and a covered sprayer using glyphosate has proved effective. Research is continuing on use of mulches and cover crops to improve soil structure.

Introduction

South Australia has its fair share of weeds, and weed and soil management problems are far from solved. As in Victoria, vineyards stretch across a wide variety of geographical locations. However, this discussion will deal with the soil management practices used in the Riverland, where most of the fruit drying occurs.

In the Riverland, as in Sunraysia, the most difficult system to manage is furrow irrigated blocks. With furrow systems the soil surface itself is used for distributing water. Riverland growers are constantly trying to improve cultural practices with better managed irrigation, weed control and nutrition. To date however, these operations are treated as separate activities. Most weed control involves cultivation or herbicides or various combinations of the two. In some situations mowing or slashing only of the mid rows is used in combination with the above. However this is only successful where there are no pest weeds present and this is the exception rather than the rule.

Weed control under vines

More and more growers are using pre-emergent herbicides under the vine rows. This includes the furrow irrigators, whose problems just begin when trying to use pre-emergent herbicides. Most have to modify weed control practices due to increasing populations of Innocent Weed, *Cenchrus longispinus* (also known as spiny burr grass), and particularly caltrop (*Tribulus terrestris*).

Different approaches are used with three-cornered jack (*Emex australis*) in comparison with caltrop or spiny burr grass, because of the different seasons involved.

The rapid growth cycle of caltrop and its presence in summer means that control is required every 3-4 weeks. The frequency of these operations is a major incentive to seek alternative control procedures. If caltrop is present in blocks, then normal cultivation on its own is not sufficient to control it, especially in the vine rows. Unless a heavy mulch layer or a thriving live sward exists, then herbicide must be used, i.e., knockdowns on a regular basis or knockdowns plus pre-emergents. Diuron, diuron plus simazine, simazine on its own or oryzalin (Surflan) plus simazine in our vine rows provides successful control of all three weeds. The main reason for successful weed control under the vines is that the soil is not disturbed.

One of the major problems with pre-emergent herbicides is that they provide only 3 - 4 months protection during summer. This requires the use of two vine row pre-emergent sprays and at least one separate vine row knockdown spray per year.

A key aspect of successful weed control under vines, apart from no disturbance of the soil, is that vines are regularly tipped. This allows access to the under vine area at all times. It also facilitates mid row activities. Emphasis is placed on chemical selection, placement, rates, calibration, timing and incorporation in the case of pre-emergents. A knockdown spray in early spring if necessary, followed by a knockdown plus pre-emergent in October or November is the normal recommendation.

Caltrop normally begins germinating in the Riverland during October. The spring pre-emergent spray only lasts to March. Then in March/April, a second pre-emergent is applied under the vines to carry through to spring. Some operators in the Riverland manage to control the under vine weeds with knockdown only sprays. Tipping is particularly important to these people.

As mentioned earlier, cultivation in the undervine area is only successful providing the pest weeds are not present. Otherwise continual disturbance of this area only worsens the problem.

Weed control within rows

The mid rows are the most difficult to manage. Since pre-emergents are not normally used, and with caltrop present, some form of weed control is required at least on a monthly basis. Cultivating regularly wears out machinery, uses fuel, requires a major labour commitment and destroys soil structure and organic matter.

Monthly weed control is a tall order. So we set about trying to develop a safe, quick, efficient and inexpensive means of achieving this. It was with these aims in mind that we developed our covered "controlled droplet" sprayer.

With the covered sprayer we regularly use glyphosate (Roundup®) at 500 mL of product per sprayed hectare. The cover minimizes the risk of off target damage to the vines from the glyphosate and allows spraying during any month of the year. Only 10 litres of mix is used per sprayed hectare and the machine is pulled behind a trike at 12 to 15 kilometres per hour. This machine adequately fulfils our mid row weed control requirements and it is used on all of our crops. As a result plantings no longer require cultivation, except before sowing the cover crops. The reduced cultivation has had a remarkable effect on the structure of our soils and soil compaction is minimized. With standing cover crops we also managed to achieve selective chemical mowing. Since only knockdown herbicides are used, continual germination of weeds occurs and this significantly aids water infiltration. Due to lack of cultivation, tractors and spray equipment can be driven into vines within 24 hours of irrigating if necessary. The mid row weed control is achieved for only $6.20 or less per sprayed hectare and the labour component has been minimized. We chose to use a controlled droplet applicator under the cover of our machine, but hydraulic hollow cone nozzles can be used equally effectively.

This is the practice that has been adopted for the mid rows during the summer months. During winter we attempt to grow as much organic matter as possible in the mid rows. The traditional practice of cultivating mid rows at the end of winter has meant that after 40 years there has not been any increase in soil organic matter content. This has influenced the choice of soil management practices.

Three-cornered jack is a major problem in the mid-rows during winter unless specific control is used. Firstly, despite the lack of time associated with vintage, cover crops are sown in late February into March. Where there is a three-cornered jack problem, trifluralin is incorporated into the mid rows and then the seed for the cover crop is sown at least twice the normal rate (i.e., 100 kg per sown hectare of cereal and 10 kg of medic). The trifluralin controls the three-cornered jacks and capeweed very well and the cover crop provides competition for the weeds. If this process does not eliminate the jacks, it at least seriously retards their growth to such an extent that by mid August they can be killed prior to seeding.

Providing competition for the pest weeds is part of the key to our future weed control. Competition can be in the form of other living plants, or from the exclusion of light by a thick mulch layer. Stable soils in nature, are never exposed to sunlight. We generally do not kill our cover crop at the end of winter, but instead, just slash it, through till the end of October. At the end of October, mulch from a successful cover crop itself will continue to suppress caltrop through to late De-

cember, an allelopathic effect. The remaining growing plants also help.

However this is not always the case and mid row spraying operations may be necessary at the end of October.

The practice of leaving the cover crop uncultivated is risky in bad frost years, but is assessed each season. Normal practices implemented at this time of the year to minimize frost damage provide some 3 to 4°C of protection. If this is a major reason for destroying organic matter by cultivating at the end of winter in non furrow blocks, then perhaps this should be re-assessed in the light of protection offered by the use of certain sprays, e.g. "Kocide", sodium bicarbonate, some potassium foliar sprays.

Leaving mulch on the surface and not disturbing the cover crop's roots, assists water penetration in heavier soils.

Breeding and selection of prostrate lucerne also has potential for soil management. Initially prostrate lucerne has been tested in citrus, where it may enhance our integrated pest control activities, provide weed control and improve soil structures. We have been aiming to grow deep rooted, prolific flowering, vigorous growing, winter dormant plants that are less than 10 cm high. They also need to have aphid tolerance and good nectar production. Last season some trial plots were established in two commercial citrus orchids, and if this work is successful, then there is no reason why it will not be applicable to most crops. Prostrate lucerne is a perennial, but there is no reason why selected annuals cannot be used. Selected annuals may provide alternative hosts for biological control vectors. Using annuals becomes feasible if the problems of adequate seed incorporation/germination with our trash seeding practices can be overcome. Trying to maintain a soil surface free of any vegetative matter during summer is very short sighted and difficult.

Some years ago Judy Tisdall and Harold Adems of Tatura developed and implemented a system of bringing large amounts of straw into the vineyard and completely covering the soil surface (as well as growing it "in-situ"). This process is not cheap in the mallee areas since up to 12 tonnes per hectare of straw is needed, which can cost as much as $800 per hectare once spread. However, they have demonstrated some outstanding results (quoted many fold increases in yields in some cases). Work at Loxton Research Centre has shown that we lose as much as 38% of water applied, to evaporation, from a bare soil surface at certain times of the year. This lends strength to the Adems/Tisdall approach.

Frank Gathercole at Loxton Research Centre, has been screening herbicides for the control of burr weeds for many years. He has been targeting caltrop, spiny burr grass and three-cornered jack. His work has covered broad acre and horticultural herbicides. Most recently he has screened some 15 herbicides and to date the results are not overly encouraging. Broad acre chemicals chlorsulfuron (Glean) and metsulfuron methyl (Ally) have been receiving attention, however they have both demonstrated ability to reduce yields.

Changes in cultural practices, particularly soil management, take up to three years to be fully realised. This is evident from changes in nutritional balance and the weed seed bank generally takes 3 years to be exhausted. There are already a number of useful tools in the form of herbicides for weed control, but as with any tools, they are only as useful as the understanding that the user has of them. Therefore the more emphasis placed on education the better.

Questions and Discussion

Q. Gary Thomas. How do you incorporate residuals in the soil without rainfall or irrigation?

A. Rely on rainfall, therefore application needs to be in mid October. Surflan and simazine are better as do not need so much rain.

Q. Gary Thomas. Can you put residuals on after the rain without watering in?

A. No.

Q. Colin Roy. If after 40 years you cannot see any benefit in organic matter levels from green manure crops then why do we use them?

A. There are immediate increases in organic matter levels, however these decline quickly over time. Cover crops also mobilize nutrients.

Comment from Don Plowman. If we did not use cover crops to supply organic matter we would expect very much lower organic matter levels than we currently have.

Q. Des Gilbey. Research with Ally showed different responses with different varieties, however application rates of up to 40 g ha^{-1} appeared safe.

A. Riverland experience suggests that two sprays of 5 g ha^{-1} results in looser bunches, smaller berries and lower yields. May be soil types account for the difference.